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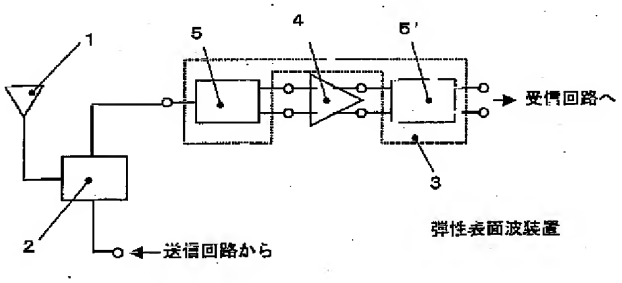
(54)【発明の名称】　弾性表面波装置及びそれを用いた通信端末装置

(57)【要約】
【課題】　受信または送信信号を処理するときに発生する雑音を極力受けずに、十分にノイズの増幅が防止された高い通信品質を有し、小型化・部品点数の削減を図ることが可能な優れた弾性表面波装置及びそれを用いた通信端末装置を提供すること。
【解決手段】　圧電基板上に、不平衡信号を平衡信号に変換する平衡信号変換フィルタ部と、前記平衡信号をフィルタリングする平衡信号フィルタ部とをなす電極が配設されて成る弾性表面波装置３とする。また、送信または受信するアンテナ１と送信回路または受信回路との間に、弾性表面波装置３を接続して成るとともに、送信または受信した信号を平衡信号変換フィルタ５と平衡信号フィルタ５’とに順次通過させるように成した通信端末装置とする。



【特許請求の範囲】
【請求項１】　圧電基板上に、不平衡信号を平衡信号に変換する平衡信号変換フィルタ部と、前記平衡信号をフィルタリングする平衡信号フィルタ部とをなす電極が配設されて成る弾性表面波装置。
【請求項２】　送信または受信するアンテナと送信回路または受信回路との間に、請求項１に記載の弾性表面波装置を接続して成るとともに、送信または受信した信号を前記平衡信号変換フィルタ部と前記平衡信号フィルタ部とに順次通過させるように成したことを特徴とする通信端末装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は移動体通信等の無線通信に用いられる弾性表面波装置及びそれを用いた通信端末装置に関するものである。
【０００２】
【従来技術とその課題】近年、移動体通信は著しい発展を遂げており、全世界的に携帯電話等の通信端末装置が広く普及しつつある。通信端末装置は小型・軽量化が進む中で、複数の通信システムに対応するマルチバンド化のために内蔵する回路が増加してきており、使用される部品の小型化、実装密度の向上、部品点数の削減が強く要望されている。
【０００３】また、通信システムが従来のアナログ伝送からデジタル伝送に向かうとともに、通信端末装置の用途は音声のみならず文字や画像等のデータ伝送にまで広がってきている。これに伴い通信端末装置の情報伝送についてはより高い通信品質が求められてきている。特に、通信端末装置の受信回路においては、デュプレクサを介して受信される微少信号が、基板回路上の各素子との配線信号から発生するノイズの影響を受けるため、ノイズを防止し受信信号の感度を向上させ、通信品質の向上を図ることが課題となっている。
【０００４】従来、受信信号に入るノイズを低減することを目的として平衡回路が使用されている。平衡回路に用いられるフィルタには、小型であることと、不平衡－平衡変換が可能であること、の２つの要求から弾性表面波フィルタが多く用いられている。
【０００５】従来の通信端末装置について、図１０を用いて説明する。図１０に示すように、アンテナ１０１から受信された信号がデュプレクサ１０２を通り、初段の弾性表面波フィルタ１０３に伝達される。また、その信号は不平衡信号の状態で伝達され増幅器１０４で増幅される。さらに、後段の弾性表面波フィルタ１０３’に伝達され平衡化（バランス化）されて、受信回路へと伝達される。
【０００６】受信信号は微弱なため、増幅器で可能な限り増幅させたいが、増幅するにしたがいフィルタを経たノイズも同様に増幅されることになる。ここで、雑音指数は下記式で表される。
【０００７】
【数１】

$$Ftotal = F1 + \frac{F2-1}{G1} + \frac{F3-1}{G1G2} + \cdots + \frac{Fn-1}{G1G2\cdots G(n-1)}$$

【０００８】式中の変数Ｆtotalは全体の雑音指数、Ｆｎは信号源（アンテナ）からのｎ個目の部品における雑音指数、Ｇｎは信号源からのｎ個目の部品の電力利得である。上記式より、受信用通信端末装置を例にとれば、アンテナ段から近い方では部品雑音を多く受けるので、このような回路構成では雑音指数が悪いことがわかる。
【０００９】そこで、本発明はこのような課題に対処するためになされたものであり、受信または送信信号を処理するときに発生する雑音を極力受けずに、十分にノイズの増幅が防止された高い通信品質を有し、小型化・部品点数の削減を図ることが可能な優れた弾性表面波装置及びそれを用いた通信端末装置を提供することを目的とする。
【００１０】
【課題を解決するための手段】上記課題を解決するために、本発明の弾性表面波装置は、圧電基板上に、不平衡信号を平衡信号に変換する平衡信号変換フィルタ部と、前記平衡信号をフィルタリングする平衡信号フィルタ部とをなす電極が配設されて成る。
【００１１】また、本発明の通信端末装置は、送信または受信するアンテナと送信回路または受信回路との間に、上記弾性表面波装置を接続して成るとともに、送信または受信した信号を前記平衡信号変換フィルタ部と前記平衡信号フィルタ部とに順次通過させるように成したことを特徴とする。
【００１２】
【発明の実施の形態】以下、本発明に係る弾性表面波装置及びそれを用いた通信端末装置の実施形態を模式的に図示した図面に基づき詳細に説明する。なお、同一部材には同一符号を付し、説明を省略する。
【００１３】図１は本発明に係る通信端末装置の実施形態を示すブロック回路である。受信信号はアンテナ１より受信され、デュプレクサ２を経て平衡信号変換フィルタ５でフィルタリングと不平衡信号から平衡信号への変換を行い増幅器４へと送信する。次に、増幅器４では極性の異なる平衡信号２つをそれぞれ増幅し、平衡信号フィルタ５’へ送信する。平衡信号フィルタ５’は２入力２出力の平衡信号のフィルタリングを行うフィルタであり、それぞれ極性の異なる信号をフィルタリングし、受信信号処理系の受信回路へと送信する。このように、本発明の通信端末装置は、送信または受信するアンテナ１と送信回路または受信回路との間に、弾性表面波装置３を接続して成り、送信または受信した信号を平衡信号変換フィルタ５と平衡信号フィルタ５’とに順次通過させ

るように成している。
【００１４】ここで、弾性表面波装置３は平衡信号変換フィルタ５と平衡信号フィルタ５’とを少なくとも備えたものである。これにより、初段で平衡信号に変換することによりノイズを十分小さくできるので、上述した雑音指数の式により、良好な弾性表面波装置や信号特性を得ることができる。
【００１５】図４に上記弾性表面波装置３において、蓋体を取り外した状態の上面図を示す。筐体２３内には、圧電基板２２上に平衡信号変換フィルタ１９及び平衡信号フィルタ２０となす電極を配し、筐体内の電極である入力電極１１，接地電極１２，第１の初段出力電極１５，第２の初段出力電極１６と平衡信号変換フィルタ１９とをワイヤ２１で接続し、さらに、第１の段間入力電極１３，第２の段間入力電極１４，第１の段間出力電極１７，第２の段間出力電極１８と平衡信号フィルタ２０とをワイヤ２１で接続して成ることで、小型で且つノイズの少ない高機能な弾性表面波装置とすることができる。
【００１６】また、平衡信号変換フィルタ１９の構成例について、図６，７，８に示す。
【００１７】図６には、圧電基板３１上にＩＤＴ電極と反射器とからなる弾性表面波共振子３６,３７，３８を梯子状に回路構成（ラダー型回路）した素子上面図を示す。この素子を平衡信号変換フィルタの一部として使用する場合、図４で示した筐体内の入力電極１１とフィルタ素子上の入力接続電極３２をワイヤ２１で接続させ、信号をフィルタ出力したフィルタ素子上の出力接続電極３３と筐体内の出力電極１５とをワイヤ２１で接続させる。そしてさらに、素子上の接地接続電極３４と筐体内の接地電極１２とをワイヤ２１で接続させ、筐体内にストリップラインの結合によるバラン（不平衡－平衡変換素子）を積層で作製し、このバランとフィルタ１９の出力信号を接続させる。
【００１８】このようにして、本例のラダー型フィルタとバランを用いることにより、受信側回路の場合は、デュプレクサを通り抜ける送信信号電力に対する、初段にかかるフィルタの耐電力性を向上させることができる。
【００１９】また、図７に２重縦結合型弾性表面波共振器（ＤＭＳ）の素子上面図を示す。この２重縦結合型弾性表面波共振器３７を平衡信号変換フィルタ１９として機能させる場合、筐体２３内の入力電極１１とフィルタ素子上の入力接続電極３２をワイヤ２１で接続させ、信号をフィルタ出力したフィルタ素子上の出力接続電極３３と筐体内の出力電極１６とをワイヤ２１で接続させる。そしてさらに、信号をフィルタ出力したフィルタ素子上の別の出力接続電極３３’と筐体内の出力電極１５とをワイヤ２１で接続させることで平衡信号変換フィルタを構成できる。
【００２０】このようにして、本例の２重縦結合型弾性表面波共振器を用いることにより、１素子で平衡信号変換フィルタを構成できるため、低コストで小型な弾性表面波装置が作製できる。
【００２１】また、図８に示すマルチＩＤＴ（Ｉｎｔｅｒ　Ｄｉｇｉｔａｌ　Ｔｒａｎｓｄｕｃｅｒ）電極構造の共振器型素子３９’、つまり、図７の２重縦結合型弾性表面波共振器３９のＩＤＴ電極を幾つも伝搬方向に縦続させた共振器においても、図７と同様に平衡信号変換フィルタを構成できる。
【００２２】本例のマルチＩＤＴ電極構造共振器を用いることにより、１素子で平衡信号変換フィルタを構成でき、コストがかからない、また、小型な弾性表面波装置が作製でき、さらに、フィルタの耐電力性を向上させることができる。
【００２３】次に、平衡信号フィルタ２０の構成例について、図９に基づき説明する。
【００２４】図９には圧電基板３１上に弾性表面波共振子３８’を格子状に回路構成（ラティス型回路）したフィルタの素子上面を図示したものである。この素子を平衡信号フィルタとして使用する場合、筐体内の入力電極１３とフィルタ素子上の入力接続電極４０をワイヤ２１で接続させ、筐体内の別の入力電極１４とフィルタ素子上の別の入力接続電極４０’をワイヤ２１で接続させ、平衡信号をフィルタ出力したフィルタ素子上の出力接続電極４１と筐体内の出力電極１７とをワイヤ２１で接続させ、さらに、平衡信号をフィルタ出力したフィルタ素子上の別の出力接続電極４１’と筐体内の別の出力電極１８とをワイヤ２１で接続させることで平衡信号フィルタを構成できる。本例のラティス型フィルタを用いることにより、受信側回路を例にとった場合、増幅器４で増幅された信号電力に対するフィルタの耐電力性を向上させることができる。
【００２５】図２に本発明に係る他の通信端末装置の実施形態を示す。この図は送信系のブロック回路に本発明の弾性表面波装置を適用した場合であり、受信系のブロック回路の図１と同様の考え方で、図中の弾性表面波装置は良好な特性を提供できる。
【００２６】また、図３に示す通信端末装置の実施形態によれば、平衡増幅器４と弾性表面波フィルタ５、５’を同一の筐体内に収容したことにより、さらなる小型弾性表面波装置ができる。
【００２７】図５にその弾性表面波装置の蓋体を取り外した状態の上面図を示す。増幅器素子２４を筐体内に収容し、平衡信号変換フィルタ１９と増幅器素子、また、増幅器素子２４と平衡信号フィルタ２０とを接続することで、より小型な高機能弾性表面波装置が作製できる。
【００２８】かくして、例えば受信信号を処理するときに発生する雑音を極力受けずに、十分ノイズ防止された高品質の通信品質を有する弾性表面波装置を提供するとともに、更に該弾性表面波装置の小型化・部品点数削減

のための、弾性表面波フィルタを提供することができる。

【００２９】なお、フィルタ素子に用いる圧電基板３１は、単結晶である、４２°または３６°Ｙカット－Ｘ伝搬のＬｉＴａO_3結晶、６４°Ｙカット－Ｘ伝搬のＬｉＮｂO_3結晶、４５°Ｘカット－Ｚ伝搬のＬｉB_4O_7結晶は電気機械結合係数が大きく且つ群遅延時間の温度係数が小さいため好ましい。圧電基板１の厚みは０．１～０．５ｍｍ程度がよく、０．１ｍｍ未満では圧電基板が脆くなり、０．５ｍｍ超では材料コストが大きくなる。

【００３０】また、フィルタとなす電極材料は、Ａｌ若しくはＡｌ合金の単層膜やＡｌ若しくはＡｌ合金と拡散性の大きい金属膜の積層材料が、耐電力向上のためには好ましい。

【００３１】ＩＤＴ電極の対数は５～２００程度、電極指の幅は０．１～１０．０μｍ程度、電極指の間隔は０．１～１０．０μｍ程度、電極指の交差幅は１０～８００μｍ程度、電極指の厚みは０．１～０．４μｍ程度とすることが、フィルタとしての所望の特性を得るうえで好適である。また、ＩＤＴ電極のＳＡＷ伝搬路の両端に、ＳＡＷを反射し効率よく共振させるための反射器を設ければ、弾性表面波の共振効率が向上し好適である。

【００３２】なおまた、本発明は上記の実施形態に限定されるものではなく、本発明の要旨を逸脱しない範囲内で種々の変更は何等差し支えない。

【００３３】

【発明の効果】以上詳細に述べたように、本発明の弾性表面波装置及び通信端末装置によれば、平衡信号変換のための弾性表面波フィルタと、平衡信号をフィルタする弾性表面波フィルタとを備えたので、十分ノイズ防止された高品質の弾性表面波装置及び通信端末装置を提供できる。

【００３４】また、同一の通過帯域を有する弾性表面波フィルタを複数含み、同一の通過帯域を有する弾性表面波フィルタどうしを縦続に接続したことをことにより、弾性表面波装置を小型化・部品点数を削減することができ、ひいては通信端末装置の小型化を図ることができる。

【００３５】また、平衡信号変換のための弾性表面波フィルタと、平衡信号をフィルタリングする弾性表面波フィルタとの間に、特定の通過帯域を増幅するための増幅器を縦続に接続したことにより、いっそう小型化・部品点数を図った弾性表面波装置及び通信端末装置を提供できる。

【００３６】さらに、共振子を回路構成させた素子やＩＤＴ電極を伝搬方向に多く縦続させた素子を用いることで、耐電力性を向上させた特性に優れた弾性表面波装置及び通信端末装置を提供できる。

【図面の簡単な説明】

【図１】本発明に係わる通信端末装置の実施形態を模式的に示す回路図である。

【図２】本発明に係わる通信端末装置の他の実施形態を模式的に示す回路図である。

【図３】本発明に係わる通信端末装置の他の実施形態を模式的に示す回路図である。

【図４】本発明に係わる弾性表面波装置の実施形態を模式的に示す平面図である。

【図５】本発明に係わる弾性表面波装置の他の実施形態を模式的に示す平面図である。

【図６】本発明に係わる平衡信号変換フィルタを模式的に説明するための平面図である。

【図７】本発明に係わる平衡信号変換フィルタを模式的に説明するための平面図である。

【図８】本発明に係わる平衡信号変換フィルタを模式的に説明するための平面図である。

【図９】本発明に係わる平衡信号フィルタを模式的に説明するための平面図である。

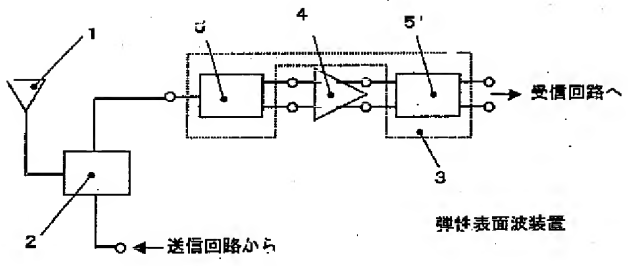
【図１０】本発明に係わる通信端末装置の実施形態を模式的に示す回路図である。

【符号の説明】

１　：　アンテナ
２　：　デュプレクサ
３　：　弾性表面波装置
４　：　電力増幅器
５　：　弾性表面波フィルタ
１１　：　不平衡入力信号接続電極
１２　：　不平衡接地信号接続電極
１３　：　平衡入力信号接続電極
１４　：　別の平衡入力信号接続電極
１５　：　平衡出力信号接続電極
１６　：　別の平衡出力信号接続電極
１７　：　平衡出力信号接続電極
１８　：　別の平衡出力信号接続電極
１９　：　平衡信号変換フィルタ
２０　：　平衡信号フィルタ
２１　：　ワイヤ
２２　：　圧電基板
２３　：　筐体
２４　：　平衡増幅器
２５　：　筐体内の仮接続電極
２６　：　筐体内の仮接続電極
２７　：　平衡信号出力電極
２８　：別の平衡信号出力電極
３１　：圧電基板
３２　：素子の入力接続電極
３３　：素子の出力接続電極
３４　：素子の接地接続電極
３５　：素子の信号接続電極
３６　：共振子
３７　：共振子

３８　　：共振子
３９　　：共振器
４０　　：素子の平衡信号入力接続電極
４１　　：素子の平衡信号出力接続電極

【図１】



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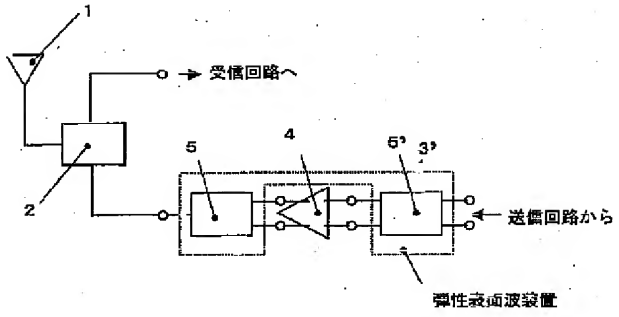

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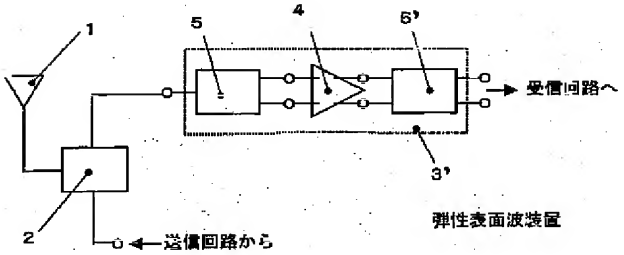

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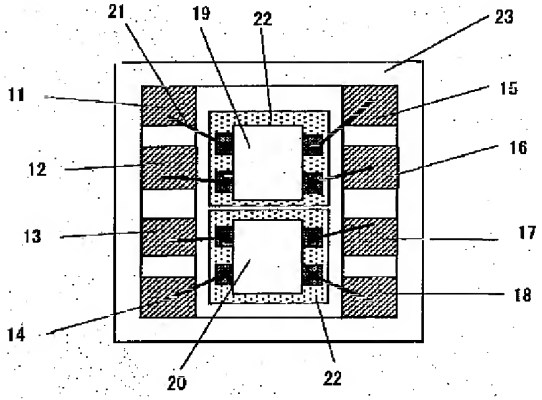

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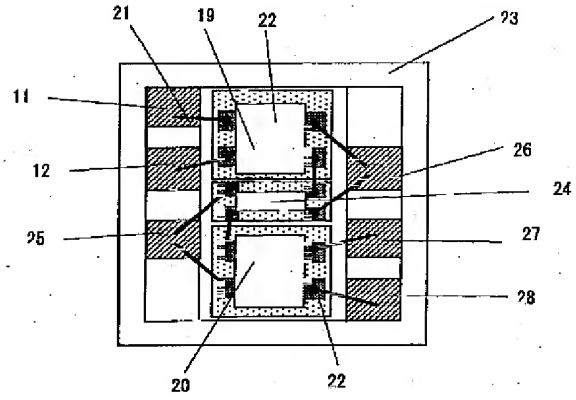

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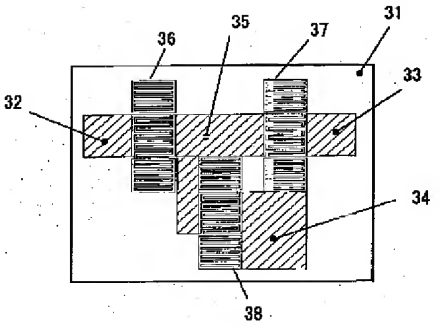

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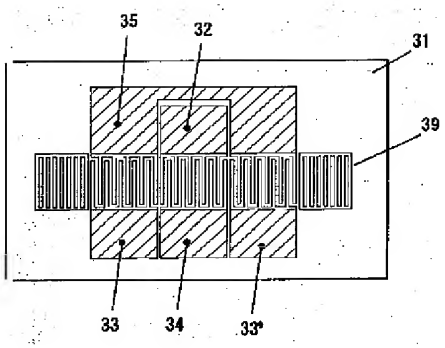
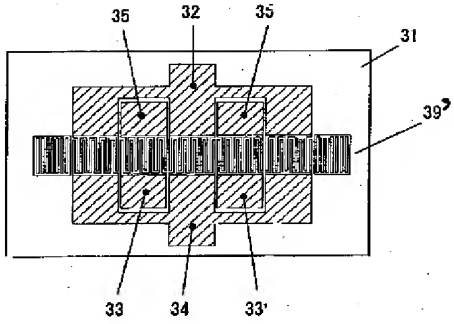
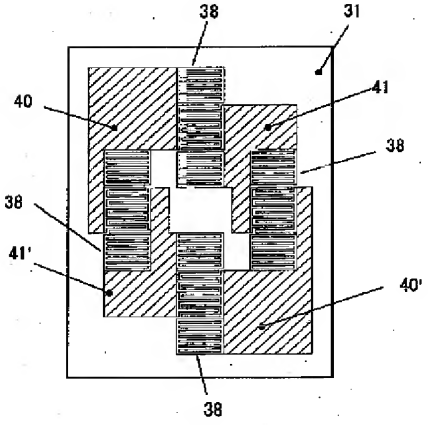

35
32
31
39
33
34
33'

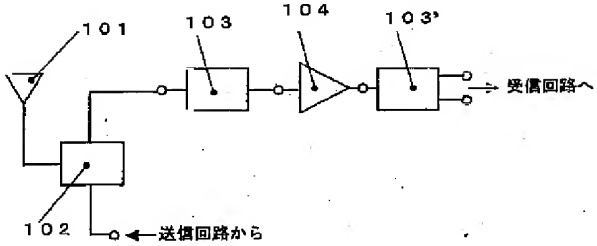
【図8】


35
32
35
31
39
33
34
33'

【図9】


38
31
40
41
38
38
41'
40'
38

【図10】


101
103
104
103'
受信回路へ
102
送信回路から

PATENT ABSTRACTS OF JAPAN

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H03H 9/25

H04B 1/48

(21)Application number : 2000-230273

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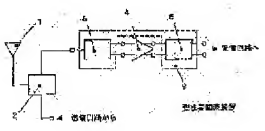
(71)Applicant : KYOCERA CORP

(72)Inventor : OTSUKA KAZUHIRO

(54) SURFACE ACOUSTIC WAVE DEVICE AND COMMUNICATION TERMINAL USING THE DEVICE



(57)Abstract:

PROBLEM TO BE SOLVED: To provide a superior surface acoustic wave device and a communication terminal using it, where it has high communication quality with its noise amplification being fully prevented to not to receive, to the utmost,

the noise generated, when its reception or transmission signal is processed, and both its miniaturization and the cutdown of the number of its parts can be made possible.

SOLUTION: A surface acoustic wave device 3 is formed, by providing on a piezoelectric substrate the electrodes of the constitutes of a balanced-signal transducing filter portion for converting an unbalanced signal to a balanced signal and by providing on a piezoelectric substrate the electrodes of the constituents of a balanced-signal filter portion for filtering the balanced signal. Also, a communication terminal is formed which connectively provides the surface acoustic wave device 3 between a transmission or reception antenna 1 and a transmission circuit of between the transmission or reception antenna 1 and a reception circuit so as to cause a transmission or reception signal to pass in succession through a balanced-signal conversion filter 5 and a balanced-signal filter 5'.

LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against

examiner's decision of rejection]

[Date of extinction of right]

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CLAIMS

[Claim(s)]

[Claim 1] Surface acoustic wave equipment which the electrode which makes the balanced signal transformation filter section which changes an unbalance signal into a balanced signal, and the balanced signal filter section which filters said balanced signal is arranged on a piezo-electric substrate, and changes.

[Claim 2] The communication terminal characterized by accomplishing so that said balanced signal transformation filter section and said balanced signal filter section may be made to carry out sequential passage of the signal transmitted or received, while connecting surface acoustic wave equipment according to claim 1 between the antennas, sending circuits, or receiving circuits which are transmitted or received and growing into it.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the surface acoustic wave equipment used for radio, such as mobile communications, and the communication terminal using it.

[0002]

[Description of the Prior Art] In recent years, mobile communications have accomplished remarkable development and communication terminals, such as a cellular phone, are spreading widely worldwide. While small and lightweight-ization progress, the circuit built in for the formation of a multi-band corresponding to two or more communication system is increasing the communication terminal, and the miniaturization of the components used, improvement in packaging density, and reduction of components mark are demanded strongly.

[0003] Moreover, while communication system goes to digital transmission from the conventional analog transmission, the application of a communication terminal is spreading even in data transmission, such as not only voice but an alphabetic character, and an image. In connection with this, higher communication link quality has been searched for about the information transmission of a communication terminal. Especially, in order to influence the very small signal received through a duplexer in the receiving circuit of a communication terminal of the noise generated from a wiring signal with each component substrate time on the street, a noise is prevented, the sensibility of an

input signal is raised and it has been a technical problem to aim at improvement in communication link quality.

[0004] The balanced circuit is used for the purpose of reducing the noise included in an input signal conventionally. Many surface acoustic wave filters are used for the filter used for a balanced circuit from two demands, a small thing and possible [unbalance-balance conversion] **.

[0005] The conventional communication terminal is explained using drawing 10 . As shown in drawing 10 , the signal received from the antenna 101 passes along a duplexer 102, and is transmitted to the surface acoustic wave filter 103 of the first rank. Moreover, the signal is transmitted in the state of an unbalance signal, and is amplified with amplifier 104. Furthermore, it is transmitted to latter surface acoustic wave filter 103', it is equilibrated (balance-izing), and is transmitted to a receiving circuit.

[0006] Although he wants to make it amplify as much as possible with amplifier since an input signal is feeble, the noise which passed through the filter will be similarly amplified as it amplifies. Here, a noise figure is expressed with the following type.

[0007]

[Equation 1]

$$Ftotal = F1 + \frac{F2-1}{G1} + \frac{F3-1}{G1G2} + \cdots + \frac{Fn-1}{G1G2\cdots G(n-1)}$$

[0008] A noise figure [in / the variable Ftotal in a formula, and / in Fn / the n-th component from the source of a signal (antenna)] and Gn are the power gain of the n-th component from the source of a signal. [the whole noise figure] If the communication terminal for reception is taken for an example, since many components noises will be received from the above-mentioned formula from an antenna stage in the nearer one, in such circuitry, it turns out that a noise figure is bad.

[0009] Then, this invention is made in order to cope with such a technical problem, and it has the high communication link quality in which magnification of

a noise was fully prevented, without receiving the noise generated when processing reception or a sending signal as much as possible, and aims at offering the outstanding surface acoustic wave equipment which can aim at reduction of a miniaturization and components mark, and the communication terminal using it.

[0010]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, the electrode which makes the balanced signal transformation filter section which changes an unbalance signal into a balanced signal, and the balanced signal filter section which filters said balanced signal is arranged on a piezo-electric substrate, and the surface acoustic wave equipment of this invention changes.

[0011] Moreover, the communication terminal of this invention is characterized by accomplishing so that said balanced signal transformation filter section and said balanced signal filter section may be made to carry out sequential passage of the signal transmitted or received while it connects the above-mentioned surface acoustic wave equipment between the antennas, sending circuits, or receiving circuits which are transmitted or received and grows into it.

[0012]

[Embodiment of the Invention] It explains to a detail based on the drawing which illustrated typically the operation gestalt of the communication terminal using the surface acoustic wave equipment and it concerning this invention hereafter. In addition, the same sign is given to the same member and explanation is omitted.

[0013] Drawing 1 is the Brock circuit which shows the operation gestalt of the communication terminal concerning this invention. It is received from an antenna 1, and an input signal performs conversion to a balanced signal from filtering and an unbalance signal with the balanced signal transformation filter 5 through a duplexer 2, and transmits to amplifier 4. Next, in amplifier 4, two balanced signals with which polarities differ are amplified, respectively, and it transmits to balanced signal filter 5'. Balanced signal filter 5' is a filter which filters the

balanced signal of 2 input 2 output, filters the signal with which polarities differ, respectively, and transmits to the receiving circuit of a reception signal processing system. Thus, the communication terminal of this invention connected surface acoustic wave equipment 3 between the antennas 1, sending circuits, or receiving circuits which are transmitted or received, grew into it, and it is accomplished so that the balanced signal transformation filter 5 and balanced signal filter 5' may be made to carry out sequential passage of the signal transmitted or received.

[0014] Here, surface acoustic wave equipment 3 is equipped with the balanced signal transformation filter 5 and balanced signal filter 5' at least. Since a noise can be made sufficiently small by changing into a balanced signal by the first rank by this, good surface acoustic wave equipment and a signal property can be acquired by the formula of the noise figure mentioned above.

[0015] The plan in the condition of having removed the lid in the above-mentioned surface acoustic wave equipment 3 to drawing 4 is shown. In a case 23, the balanced signal transformation filter 19 and the balanced signal filter 20, and the electrode to make are arranged on the piezo-electric substrate 22. An output electrode 16 and the balanced signal transformation filter 19 are connected with a wire 21. the input electrode 11 which is an electrode in a case, an earth electrode 12, and the 1st first rank -- an output electrode 15 and the 2nd first rank -- Furthermore, the 1st stage intercadence force electrode 13, the 2nd stage intercadence force electrode 14, the 1st interstage output electrode 17, the 2nd interstage output electrode 18, and the balanced signal filter 20 can be used as small and highly efficient surface acoustic wave equipment with few noises by connecting and changing with a wire 21.

[0016] Moreover, the example of a configuration of the balanced signal transformation filter 19 is shown in drawing 6 , and 7 and 8.

[0017] The component plan which carried out the circuitry (ladder mold circuit) of the surface acoustic wave resonators 36, 37, and 38 which consist of an IDT electrode and a reflector on the piezo-electric substrate 31 to the shape of a

ladder is shown in drawing 6 . When using this component as some balanced signal transformation filters, the input electrode 11 in the case shown by drawing 4 and the input connection electrode 32 on a filter element are connected with a wire 21, and the output connection electrode 33 on the filter element which carried out the filter output of the signal, and the output electrode 15 in a case are connected with a wire 21. And further, the ground connection electrode 34 on a component and the earth electrode 12 in a case are connected with a wire 21, into a case, the balun (unbalance-balance sensing element) by association of a stripline is produced in a laminating, and the output signal of this balun and a filter 19 is connected.

[0018] Thus, in the case of a receiving-side circuit, the power-proof nature of the filter concerning the first rank to the sending-signal power which passes through a duplexer can be raised by using the ladder mold filter and balun of this example.

[0019] Moreover, the component plan of a double length joint mold surface acoustic wave resonator (DMS) is shown in drawing 7 . When operating this double length joint mold surface acoustic wave resonator 37 as a balanced signal transformation filter 19, the input electrode 11 in a case 23 and the input connection electrode 32 on a filter element are connected with a wire 21, and the output connection electrode 33 on the filter element which carried out the filter output of the signal, and the output electrode 16 in a case are connected with a wire 21. And a balanced signal transformation filter can consist of connecting further the output electrode 15 in another output connection electrode 33' and the case on the filter element which carried out the filter output of the signal with a wire 21.

[0020] Thus, since a balanced signal transformation filter can be constituted from one element by using the double length joint mold surface acoustic wave resonator of this example, small surface acoustic wave equipment is producible by low cost.

[0021] Moreover, also in the resonator which made many IDT electrodes of resonator mold component 39'39 of the multi-IDT (Inter Digital Transducer)

electrode structure shown in drawing 8 , i.e., the double length joint mold surface acoustic wave resonator of drawing 7 , concatenate in the propagation direction, a balanced signal transformation filter can be constituted like drawing 7 .

[0022] Moreover it can constitute a balanced signal transformation filter from one element and cost does not start by using the multi-IDT electrode structure resonator of this example, small surface acoustic wave equipment can be produced and the power-proof nature of a filter can be raised further.

[0023] Next, the example of a configuration of the balanced signal filter 20 is explained based on drawing 9 .

[0024] The component top face of the filter which carried out the circuitry (lattice mold circuit) of surface acoustic wave resonator 38' to the shape of a grid is illustrated on the piezo-electric substrate 31 at drawing 9 . When using this component as a balanced signal filter, the input electrode 13 in a case and the input connection electrode 40 on a filter element are connected with a wire 21. Another input connection electrode 40' on a filter element is connected to another input electrode 14 in a case with a wire 21. The output connection electrode 41 on the filter element which carried out the filter output of the balanced signal, and the output electrode 17 in a case are connected with a wire 21. Furthermore, a balanced signal filter can consist of connecting another output connection electrode 41' on the filter element which carried out the filter output of the balanced signal, and another output electrode 18 in a case with a wire 21. When a receiving-side circuit is taken for an example by using the lattice mold filter of this example, the power-proof nature of a filter to the signal power amplified with amplifier 4 can be raised. [0025] The operation gestalt of other communication terminals applied to this invention at drawing 2 is shown. This drawing is the case where the surface acoustic wave equipment of this invention is applied to the Brock circuit of a transmitting system, it is the same view as drawing 1 of the Brock circuit of a receiving system, and the surface acoustic wave equipment in drawing can offer a good property.

[0026] Moreover, according to the operation gestalt of the communication

terminal shown in drawing 3 , the further small surface acoustic wave equipment is made by having held a balanced amplifier 4, the surface acoustic wave filter 5, and 5' in the same case.

[0027] The plan in the condition of having removed the lid of the surface acoustic wave equipment to drawing 5 is shown. The amplifier component 24 is held in a case and smaller highly efficient surface acoustic wave equipment can be produced by connecting the balanced signal transformation filter 19, an amplifier component and the amplifier component 24, and the balanced signal filter 20.

[0028] While offering the surface acoustic wave equipment which has the communication link quality of the high quality by which noise prevention was carried out enough, without receiving the noise generated in this way when processing an input signal as much as possible, the surface acoustic wave filter for a miniaturization and components mark reduction of these surface acoustic wave equipments can be offered further.

[0029] In addition, since [that an electromechanical coupling coefficient is large and] the piezo-electric substrate 31 used for a filter element has the small temperature coefficient of group delay, it is desirable. [of LiTaO3 crystal of the 42-degree or 36 degreeY cut-X propagation which is a single crystal, LiNbO3 crystal of 64 degreeY cut-X propagation, and 4OLiB7 crystal of 45 degreeX cut-Z propagation] The thickness of the piezo-electric substrate 1 has about 0.1-0.5 goodmm, a piezo-electric substrate becomes weak in less than 0.1mm, and ingredient cost becomes large in 0.5mm **.

[0030] Moreover, a filter and the electrode material to make have the desirable charge of a laminated wood of the large metal membrane of aluminum, the monolayer of aluminum alloy and aluminum or aluminum alloy, and diffusibility for the improvement in power-proof.

[0031] The width of face of five to about 200 and an electrode finger of the logarithm of an IDT electrode is suitable for spacing of about 0.1-10.0 micrometers and an electrode finger, when it acquires the desired property as a filter that the crossover width of face of about 0.1-10.0 micrometers and an

electrode finger sets thickness of about 10-800 micrometers and an electrode finger to about 0.1-0.4 micrometers. Moreover, if the reflector for reflecting SAW in the both ends of the SAW propagation path of an IDT electrode, and resonating them efficiently is prepared, the resonance effectiveness of a surface acoustic wave improves and is suitable.

[0032] In addition, this invention is not limited to the above-mentioned operation gestalt, and modification various by within the limits which does not deviate from the summary of this invention does not interfere at all again.

[0033]

[Effect of the Invention] Since it had the surface acoustic wave filter for balanced signal transformation, and the surface acoustic wave filter which carries out the filter of the balanced signal according to the surface acoustic wave equipment and the communication terminal of this invention as stated to the detail above, the surface acoustic wave equipment and the communication terminal of high quality by which noise prevention was carried out enough can be offered.

[0034] Moreover, a miniaturization and components mark can be reduced [having connected to concatenation the surface acoustic wave filters which have two or more implications and the same passband for the surface acoustic wave filter which has the same passband] for surface acoustic wave equipments by things, as a result the miniaturization of a communication terminal can be attained.

[0035] Moreover, the surface acoustic wave equipment and the communication terminal which planned a miniaturization and components mark further can be offered by having connected to concatenation the amplifier for amplifying a specific passband between the surface acoustic wave filter for balanced signal transformation, and the surface acoustic wave filter which filters a balanced signal.

[0036] Furthermore, surface acoustic wave equipment and a communication terminal excellent in the property which raised power-proof nature can be offered by using the component to which the circuitry of the resonator was carried out,

and the component which made many IDT electrodes in the propagation direction concatenate.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the circuit diagram showing typically the operation gestalt of the communication terminal concerning this invention.

[Drawing 2] It is the circuit diagram showing typically other operation gestalten of the communication terminal concerning this invention.

[Drawing 3] It is the circuit diagram showing typically other operation gestalten of the communication terminal concerning this invention.

[Drawing 4] It is the top view showing typically the operation gestalt of the surface acoustic wave equipment concerning this invention.

[Drawing 5] It is the top view showing typically other operation gestalten of the surface acoustic wave equipment concerning this invention.

[Drawing 6] It is a top view for explaining typically the balanced signal transformation filter concerning this invention.

[Drawing 7] It is a top view for explaining typically the balanced signal

transformation filter concerning this invention.

[Drawing 8] It is a top view for explaining typically the balanced signal transformation filter concerning this invention.

[Drawing 9] It is a top view for explaining the balanced signal filter concerning this invention typically.

[Drawing 10] It is the circuit diagram showing typically the operation gestalt of the communication terminal concerning this invention.

[Description of Notations]

1 : Antenna

2 : Duplexer

3 : Surface Acoustic Wave Equipment

4 : Power Amplifier

5 : Surface Acoustic Wave Filter

11 : Unbalanced Input Signal Connection Electrode

12 : Unbalance Touch-down Signal Connection Electrode

13 : Balanced Input Signal Connection Electrode

14 : Another Balanced Input Signal Connection Electrode

15 : Balanced Output Signal Connection Electrode

16 : Another Balanced Output Signal Connection Electrode

17 : Balanced Output Signal Connection Electrode

18 : Another Balanced Output Signal Connection Electrode

19 : Balanced Signal Transformation Filter

20 : Balanced Signal Filter

21 : Wire

22 : Piezo-electric Substrate

23 : Case

24 : Balanced Amplifier

25 : Temporary Connection Electrode in Case

26 : Temporary Connection Electrode in Case

27 : Balanced Signal Output Electrode

28 : Another Balanced Signal Output Electrode

31 : Piezo-electric Substrate

32 : Input Connection Electrode of Component

33 : Output Connection Electrode of Component

34 : Ground Connection Electrode of Component

35 : Signal Connection Electrode of Component

36 : Resonator

37 : Resonator

38 : Resonator

39 : Resonator

40 : Balanced Signal Input Connection Electrode of Component

41 : Balanced Signal Output Connection Electrode of Component

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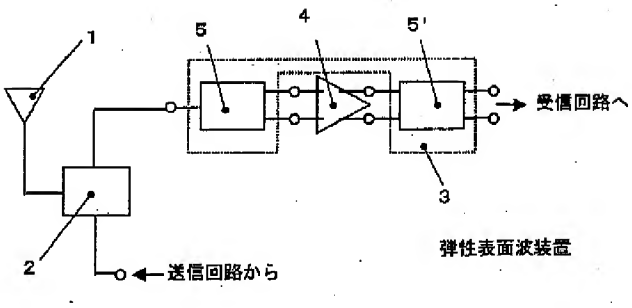
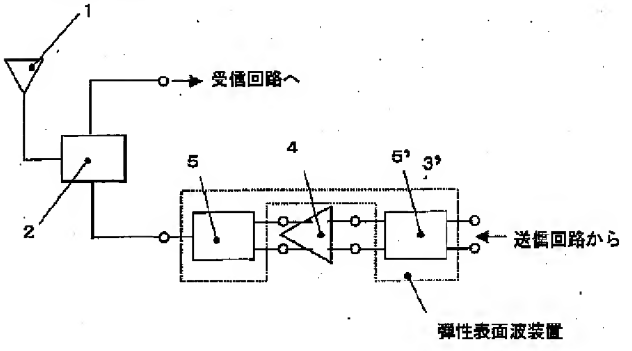
DRAWINGS

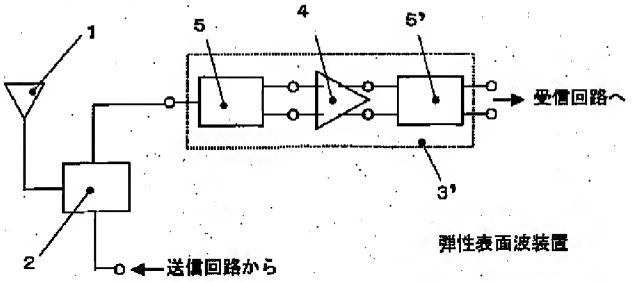
[Drawing 1]



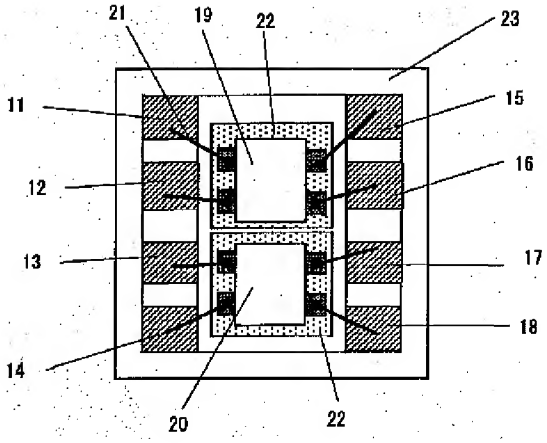
[Drawing 2]



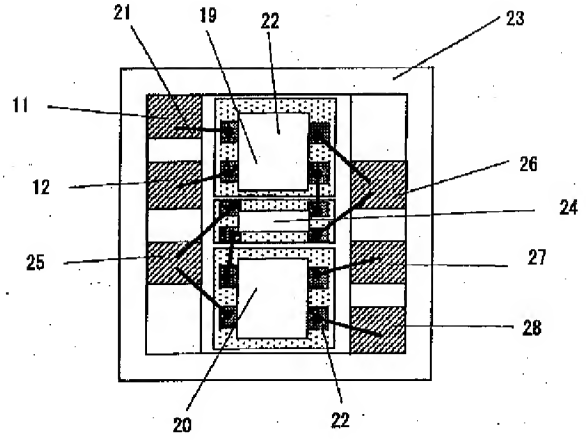
[Drawing 3]



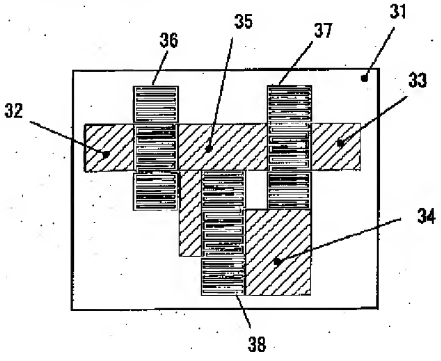
[Drawing 4]



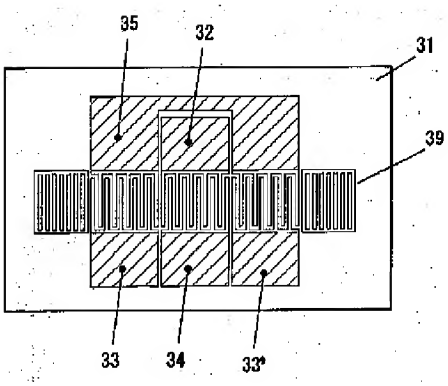
[Drawing 5]



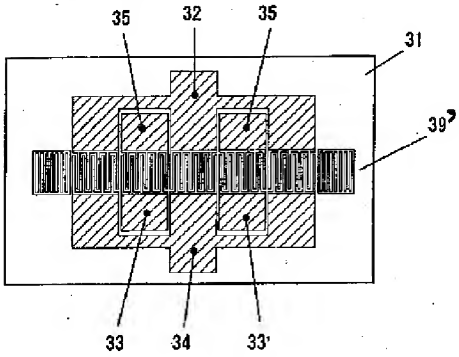
[Drawing 6]



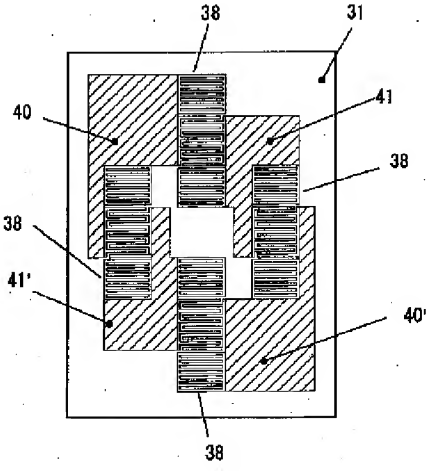
[Drawing 7]



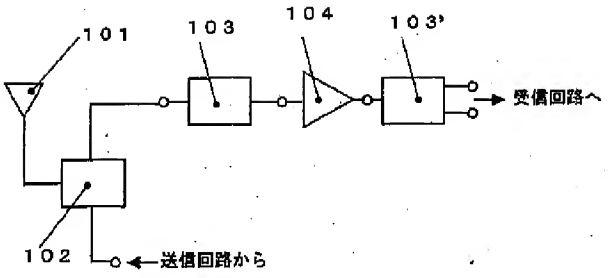
[Drawing 8]



[Drawing 9]



[Drawing 10]



[Translation done.]